

What is claimed is:

- Full 1/26
1. An active matrix display and sensor apparatus, comprising: an array of display picture elements arranged as rows and columns, each picture element having a display data input for receiving image data to be displayed and a scan input for enabling input of image data from the data input, said data inputs of said picture elements of each column being connected to a respective column data line and said scan inputs of said picture elements of each row being connected to a respective row scan line; a data signal generator for supplying data signals to the column data lines; a scan signal generator for supplying scan signals to said row scan lines; and an output arrangement connected to said column data lines for outputting sensor signals generated by and within said display picture elements in response to external stimuli.
  2. An apparatus as claimed in claim 1, wherein said sensor signals are generated by and within the optically variable region of the display picture elements.
  3. An apparatus as claimed in claim 1, comprising a display substrate on which are integrated said data signal generator, said scan signal generator, said output arrangement, and electronic components of the array.
  4. An apparatus as claimed in claim 3, in which said data signal generator is disposed along a first edge of said array and said output arrangement is disposed along a second edge of said array opposite said first edge.
  5. An apparatus as claimed in claim 1, in which each of said picture elements comprises an image generating element and an electronic switch.
  6. An apparatus as claimed in claim 5, in which each of said image generating elements comprises a liquid crystal element.
  7. An apparatus as claimed in claim 5, in which each of said picture elements comprises a storage capacitor.

8. An apparatus as claimed in claim 5, in which each of said electronic switches comprises a thin film transistor.

9. An apparatus as claimed in claim 8, in which each of said transistors has a gate connected to said picture element scan input, a source connected to said picture element data input, and a drain connected to said image generating element.

10. An apparatus as claimed in claim 1, comprising a controller for controlling at least one of said data and scan signal generators and said output arrangement.

*comprising a controller for controlling at least one of said data and scan signal generators and said output arrangement,*

11. An apparatus as claimed in ~~claim 10 when dependent on claim 3 or 4~~ in which said controller is integrated on said display substrate.

12. An apparatus as claimed in claim 11, comprising active devices embodied as thin film transistors.

13. An apparatus as claimed in claim 10, in which said controller is arranged to control which of said picture element sensor signals are output by said output arrangement.

14. An apparatus as claimed in claim 13, in which said controller is programmable to determine which of said picture element sensor signals are output by said output arrangement.

15. An apparatus as claimed in claim 14, in which said controller is reprogrammable during operation of the apparatus to change which of said picture element sensor signals are output by said output arrangement.

16. An apparatus as claimed in claim 10, in which said controller is arranged to control operation of said data and scan signal generators and said output arrangement to define alternating image writing phases and sensor reading phases.

17. An apparatus as claimed in claim 16, in which a frame of image data is written to said array during each said writing phase.
18. An apparatus as claimed in claim 16, in which each said reading phase occurs during a vertical blanking period between consecutive said writing phases.
19. An apparatus as claimed in claim 16, in which at least one row of image data is written to said array during each said writing phase.
20. An apparatus as claimed in claim 19, in which each said reading phase comprises outputting said sensor signals from at least one row of picture elements after said at least one row to which image data were written during a preceding writing phase.
21. An apparatus as claimed in claim 16, in which sensor signals of all of said picture elements are output during each said reading phase.
22. An apparatus as claimed in claim 16, in which the sensor signals of a proper subset of all of said picture elements are output during each said reading phase.
23. An apparatus as claimed in claim 22, in which the sensor signals of the same proper subset of said picture elements are output during said reading phases.
24. An apparatus as claimed in claim 22, in which said proper subset of picture elements comprises different picture elements during each reading phase of a group of reading phases such that said sensor signals of all of said picture elements are output during each group of said reading phases.
25. An apparatus as claimed in claim 22, in which said proper subset of picture elements comprises at least one group of rows of picture elements, the or each group containing at least one row.

26. An apparatus as claimed in claim 25, in which said at least one group comprises a plurality of groups which are substantially evenly spaced in the column direction of said array.
27. An apparatus as claimed in claim 25, in which said at least one group comprises a plurality of adjacent rows.
28. An apparatus as claimed in claim 13, in which said controller is arranged to control operation of said data and scan signal generators and said output arrangement to write image data to and to read sensor signals from said array simultaneously.
29. An apparatus as claimed in claim 28, in which said data signal generator is arranged to supply image data to first ones of said data lines and said output arrangement is arranged to read sensor signals simultaneously from second ones of said data lines different from said first ones for each row of said picture elements.
30. An apparatus as claimed in claim 29, in which said first and second ones are the same for all of the rows of said picture elements.
31. An apparatus as claimed in claim 1, in which said output arrangement is responsive to a characteristic of said picture elements comprising at least one of voltage, current, stored charge and capacitance.
32. An apparatus as claimed in claim 1, in which said output arrangement comprises a plurality of sense amplifiers connected to said column data lines.
33. An apparatus as claimed in claim 32, in which the number of sense amplifiers is less than the number of data lines and each sense amplifier is connectable to any one of a respective set of said data lines by a respective first multiplexer.
34. An apparatus as claimed in claim 32 in which said output arrangement comprises a plurality of analog/digital converters connected to outputs of said sense amplifiers.

35. An apparatus as claimed in claim 34, in which the number of said converters is less than the number of said sense amplifiers and each said sense amplifier is connectable to any one of a respective set of said sense amplifier outputs by a respective second multiplexer.

36. An apparatus as claimed in claim 34, in which said output arrangement comprises a shift register for converting parallel outputs from said converters to a serial output.